



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**10.01.2001 Bulletin 2001/02**

(51) Int. Cl.<sup>7</sup>: **G06K 7/08**

(21) Application number: **00305800.5**

(22) Date of filing: **10.07.2000**

(84) Designated Contracting States:  
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU**  
**MC NL PT SE**  
 Designated Extension States:  
**AL LT LV MK RO SI**

(30) Priority: **09.07.1999 JP 19670099**

(71) Applicant:  
**SANKYO SEIKI MFG. CO. LTD.**  
**Suwa-gun, Nagano-ken 393-8511 (JP)**

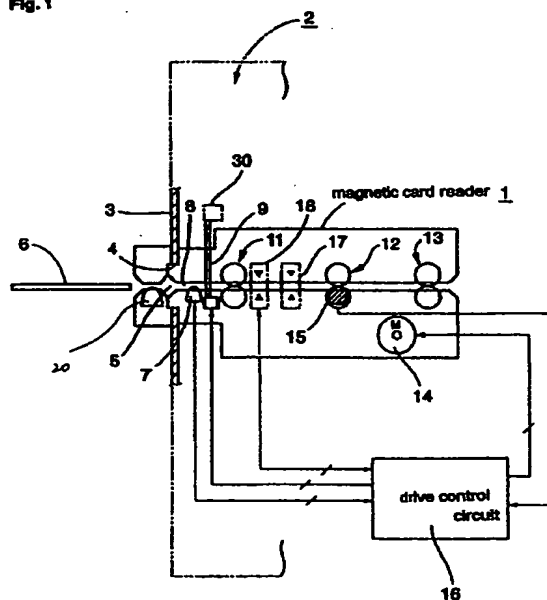
(72) Inventors:  
 • **Nagata, Shigeyuki**  
**Suwa-gun, Nagano (JP)**  
 • **Hirasawa, Kenji**  
**Suwa-gun, Nagano (JP)**  
 • **Uemura, Yoshiharu**  
**Suwa-gun, Nagano (JP)**

(74) Representative:  
**Kinsler, Maureen Catherine et al**  
**Kilburn & Strode,**  
**20 Red Lion Street**  
**London WC1R 4PJ (GB)**

(54) **Magnetic card transaction apparatus**

(57) A magnetic card transaction apparatus having a card slot (5) through which a magnetic card (6) is insertable and a card transferring means (11) for transferring said magnetic card (6) inserted into said card slot (5). Also provided is a means for causing a discontinuity in the transfer of said magnetic card (6) by said card transferring means when the magnetic card (6) projects outwardly from the card slot (5).

**Fig. 1**



## Description

[0001] The present invention relates to a magnetic card transaction apparatus having a magnetic card reader; more specifically, it relates to a magnetic card transaction apparatus having a function to prevent incorrect reading of a magnetic card.

[0002] A magnetic card reader is attached to a magnetic card transaction apparatus which performs various transactions using a magnetic card, such as an ATM found in a bank. At a card insertion area of a magnetic card reader, in general, one finds the following in order in the direction of a card to be inserted: a card slot through which a magnetic card is inserted or ejected; a card insertion detector which detects the magnetic card inserted therein; a guiding path which guides the magnetic card inserted from the card slot to the inside of the apparatus; and a shutter which opens and closes the guiding path.

[0003] When a user inserts a magnetic card into a card slot, a magnetic strip at the end of the inserted magnetic card is detected by a card insertion detector; then, a shutter is opened such that the magnetic card can be taken in. The inside of the shutter has a pair of card transferring rollers which forms a transferring means for a magnetic card; the inserted magnetic card is held to be taken in by the card transferring rollers.

[0004] In order to avoid undesired sensations, such as a sensation of the magnetic card being stuck, from being sensed by a user when a magnetic card is inserted, the shutter is opened while the pair of card transferring rollers are driven as soon as insertion of the magnetic card is detected by the card insertion detector; therefore, the magnetic card can be smoothly taken following insertion of the magnetic card by a user.

[0005] On the other hand, the amount of projection of the card from the card slot at the time of ejection is maximized in order for the user to readily remove the card from the card slot.

[0006] In a magnetic card reader described above, insertion of a magnetic card is such that the end of the magnetic card is inserted to a card slot then the card is transferred by a pair of card transferring rollers at a given speed. Similarly, ejection of a magnetic card is such that the magnetic card is transferred by the pair of card transferring rollers at a given speed until the card is actually ejected from the card slot.

[0007] Therefore, when a magnetic head is attached to the outside of the card slot (in order to perform an illegal act), the magnetic card is transferred at a given speed along the position for detecting the magnetic head. Consequently, information recorded on the magnetic card can be read out by the magnetic head attached to the outside of the card slot.

[0008] The present invention intends to provide a magnetic card transaction apparatus which is configured such that a magnetic card inserted or ejected from a card slot cannot be read out by a magnetic head

attached to the outside of the card slot.

[0009] Various aspects of the present invention are defined in the independent claims. Some preferred features are defined in the dependent claims.

[0010] According to one aspect of the present invention, there is provided a magnetic card transaction apparatus comprising a card slot through which a magnetic card is inserted; a card transferring means which takes in said magnetic card inserted from said card slot; and a temporary suspension means which suspends operation of taking said magnetic card by said card transferring means when the back end of said magnetic card projects out from said card slot.

[0011] According to another aspect of the present invention, there is provided magnetic card transaction apparatus comprising a card slot through which a magnetic card is inserted; a card transferring means which takes in said magnetic card inserted from said card slot; and a reverse direction transferring means which, when the back end of said magnetic card projects out from said card slot, temporarily suspends operation of taking in said magnetic card by said card transferring means and which temporarily transfers said magnetic card in the reverse direction.

[0012] According to yet another aspect of the present invention, there is provided magnetic card transaction apparatus comprising a card slot through which a magnetic card is ejected; a card transferring means which ejects said magnetic card from said card slot; and a temporary suspension means which suspends operation of ejecting said magnetic card by said card transferring means when said magnetic card is ejected from said card slot by a given amount.

[0013] According to a yet further aspect of the present invention, there is provided magnetic card transaction apparatus comprising a card slot through which a magnetic card is ejected; a card transferring means which ejects said magnetic card inserted from said card slot; and a reverse direction transferring means which, when said magnetic card is ejected from said card slot by a given amount, temporarily suspends operation of ejecting said magnetic card by said card transferring means and which temporarily transfers said magnetic card in the reverse direction.

[0014] According to a still further aspect of the present invention, there is provided magnetic card transaction apparatus comprising a card slot from which a magnetic card is inserted; a detecting means which detects that said magnetic card is inserted from said card slot; a card transferring means which takes in said magnetic card; a shutter means which opens or closes a card guiding path guiding said magnetic card inserted from said card slot to said card transferring means; and a control means which controls said shutter means to open said card guiding path when said detecting means detects that said magnetic card is inserted and which drives said card transferring means to transfer said magnetic card a given period of time after said card

guiding path is opened.

[0015] According to yet another aspect of the present invention, there is provided magnetic card transaction apparatus comprising a card slot from which a magnetic card is inserted; a card insertion detecting means which detects that said magnetic card is inserted from said card slot; a card transferring means which takes in said magnetic card; a shutter means which opens or closes a card guiding path guiding said magnetic card inserted from said card slot to said card transferring means; a detecting means which detects that said magnetic card inserted from said card slot comes in contact with said shutter means; and a shutter controlling means which opens said guiding path by driving said shutter means after said detecting means detects that said magnetic card comes in contact with said shutter means.

[0016] Various aspects of the present invention will now be described by way of example only and with reference to the accompanying drawings of which:

Figure 1 is a schematic configuration showing major parts of a magnetic card transaction apparatus according to the present invention.

Figure 2 (a) is a flowchart showing an operation of taking in a magnetic card about the apparatus of Figure 1.

Figure 2 (b) is a flowchart showing an operation of ejecting the magnetic card about the apparatus of Figure 1.

Figure 3 (a) is an operation of taking in a magnetic card.

Figure 3 (b) is an operation of ejecting the magnetic card.

Figure 4 is a flowchart showing another example of an operation of taking in a magnetic card in the apparatus of Figure 1.

Figure 5 is a flowchart showing yet another example of an operation of taking in a magnetic card in the apparatus of Figure 1.

Figure 6 is a configuration showing a modified example of the apparatus of Figure 1.

Figure 7 is a configuration showing another modified example of the apparatus of Figure 1.

Figure 8 is a configuration showing yet another modified example of the apparatus of Figure 1.

[0017] Figure 1 is a schematic configuration of major parts of a magnetic card reader which is attached to a magnetic card transaction apparatus, such as an ATM. Magnetic card reader 1 of this embodiment is fixed to the back side of card slot opening 4 formed at front panel 3 of magnetic card transaction apparatus 2.

[0018] Magnetic card reader 1 comprises: card slot 5 for insertion and ejection of a magnetic card; magnetic head 7 as a card insertion detector which detects magnetic card 6 inserted from card slot 5; guiding path 8 which guides magnetic card 6, inserted from card slot 5,

to the inside of the apparatus; and shutter 9 which opens and closes guiding path 8. These parts are placed in the above order in the direction of a card to be inserted.

[0019] A pair of card transferring rollers 11 is placed at the end of shutter 9. Magnetic card 6 is taken in by rollers 11 and is transferred along a transferring path defined by a plurality of pairs of transferring rollers 12, 13 which are placed with a given distance. The spacing between rollers 11 and 12 is slightly less than the length of the card 6. Likewise, the spacing between rollers 12 and 13 is slightly less than the length of the card 6. Each pair of rollers 11 through 13 are rotated by drive motor 14. Magnetic head 15 is placed at a position of rollers 12 for reading a magnetic strip on magnetic card 6 which passes thereby.

[0020] Drive control circuit 16 is to control the drive of each part and is configured of a microcomputer. It controls operations of taking in magnetic card 6 and reading out by magnetic head 15 according to a control program stored in a ROM thereof. Also, photo sensors 17, 18 are to detect positions of magnetic card 6 described later.

[0021] The following describes operations of taking in and ejection of a magnetic card in this embodiment of magnetic card reader 1 in reference to a flowchart in Figure 2 and a configuration in Figure 3.

[0022] First, the operation of taking in magnetic card 6 is described herein according to a flowchart in Figure 2 (a). When a user inserts magnetic card 6 through card slot 5, magnetic head 7 or a sensor (not shown in the figure) detects a magnetic strip formed on inserted magnetic card 6 (ST1). Based on detection signals from magnetic head 7, drive control circuit 16 rotates (starts) motor 14 to drive a transferring system including transferring rollers 11; shutter 9 is opened at the same time (ST2).

[0023] As a result, magnetic card 6 can be taken in. When it passes the shutter position while being taken in, the end of the card is held by a pair of rollers 11 such that taking in of magnetic card 6 is started.

[0024] In this embodiment, when the back end of magnetic card 6 projects from card slot 5 after motor 14 is rotated (started), motor 14 is temporarily suspended to suspend operation of taking in magnetic card 6. Time of suspending motor 14 can be controlled based on a period of time since detection of the card by photo sensors 18. Also, it can be controlled based on a period of time since detection of magnetic head 7 for detecting insertion of a card. Suspension of magnetic card 6 is established to be 100 to 500ms in this embodiment (ST3).

[0025] Thereafter, motor 14 is activated (ST4) to restart taking in magnetic card 6. After magnetic card 6 is taken in to the position of magnetic head 15, formed in the card reader (ST5), magnetic head 15 performs reading out or writing from or onto magnetic card 6 (ST6).

[0026] In the operation of taking in magnetic card 6 of this embodiment, the operation is temporarily suspended while the back end of magnetic card 6 projects from card slot 5 and is continued after a given period of time. As a result, even when magnetic head 20 is (illegally) attached to the outside of card slot 5, such as on the surface of front panel 3, as indicated with an imaginary line in Figure 3 (a), magnetic card 6 is temporarily stopped such that magnetic head 20 cannot completely read out magnetically recorded information of inserted magnetic card 6. Therefore, illegal reading out of magnetically recorded information by magnetic head 20 can be prevented. It should be noted, however, that the apparatus is arranged so that stopping the card in this way to prevent illegal reading thereof does not effect the authorised reading of the card by the magnetic head 15.

[0027] The following describes ejection of magnetic card 6 in magnetic card reader 1 of this embodiment in reference to a flowchart of Figure 2 (b). Herein, pairs of rollers 11 through 13 start ejection of magnetic card 6 (ST11). When photo sensor 17 detects the back end of magnetic card 6 in the direction of ejection (ST12), the ejection operation is temporarily suspended (ST13).

[0028] As shown in Figure 3 (b), when photo sensor 17 detects the back end of magnetic card 6, the front end of magnetic card in the direction of ejection projects out of card slot 5 by a given amount. Also, suspension of ejection of the card is established to be 100 to 500ms.

[0029] After the period of suspension passes, motor 14 is rotated (started) to restart ejection of magnetic card 6 (ST14). Thereafter, photo sensor 18, located on the side closer to card slot 5 than photo sensor 17, detects the back end of magnetic card 6 (ST15); then, motor 14 is stopped to complete ejection of the card.

[0030] Upon completion of ejection of the card, the back end of magnetic card 6 is still held in rollers 11. As a user lightly pulls magnetic card 6, it can be removed from card slot 5. Also, when the user forgets to remove magnetic card 6, magnetic card 6 can be retrieved to the inside after a given period of time by driving the pair of transferring rollers 11.

[0031] In magnetic card reader 1 of this embodiment, when a magnetic card is ejected, the operation of ejection is suspended while the end of the card to be ejected projects from card slot 5. Therefore, even though magnetic head 20 is (illegally) attached to the front panel as indicated with an imaginary line in Figure 3 (b), one can prevent magnetically recorded information of magnetic card 6, which is ejected through magnetic head 20, from being read out.

[0032] According to magnetic card reader 1 of this embodiment, transferring of the card is suspended only once during taking in and ejection of the card. However, one may modify it such that suspension of transferring the card can be repeated twice or more. In other words, one can repeat ST3, ST4 or ST13, ST14 of Figure 2.

[0033] Also, time for suspension of transferring the card is established to be 100 to 500ms in this embodi-

ment. This range of time allows a user to insert a magnetic card without sensing undesired sensations, such as the card being stuck. However, the range of time can be either shorter or longer than one indicated above.

(Another example of taking in and ejection of a magnetic card)

[0034] To prevent reading out of magnetic card 6, which is inserted or ejected from card slot 5, by a magnetic head (illegally) attached to the outside of card slot 5, the following operation to control operation of taking in and ejection of magnetic card can be performed.

[0035] The first method of control is to temporarily transfer magnetic card 6 in the reverse direction during taking in or ejection of the card. When magnetic card 6 is taken in, a motor is rotated in the reverse direction to temporarily transfer magnetic card 6 in the reverse direction as the direction for ejection, instead of performing ST3 (suspending the motor) of Figure 2 (a); then, operation of taking in the card is restarted. The reverse transferring can be repeated for a plurality of times.

[0036] When magnetic card 6 is ejected, motor 14 is rotated in the reverse direction to temporarily transfer magnetic card 6 for a given period of time in the reverse direction as the direction for taking in, instead of performing ST13 (suspending the motor) of Figure 2 (b); then, operation of ejection is restarted. The reverse transferring can be repeated for a plurality of times.

[0037] The second method of control is to rotate (start) motor 14 for transferring the card not at the same time of opening of shutter 9, but after a given period of time such that transferring of magnetic card 6 is temporarily suspended. In this case, as shown in Figure 4, after shutter 9 is opened in ST22, a given period of time is counted in ST23; thereafter, motor 15 is rotated (started) in ST24. The rest of the process, ST21, ST25, ST26 are identical to ST1, ST5, ST6 of Figure 2 (a).

[0038] By delaying rotation (start) of the motor, magnetic card 6 inserted from card slot 5 is temporarily stopped while being inserted between transferring rollers 11 since rollers 11 have not started rotating. Hence, one may prevent recorded information on the magnetic card, which is inserted via the magnetic head illegally attached to the outside of card slot 5, from being read out.

[0039] The third method of control is to open shutter 9 after detecting that the end of inserted magnetic card 6 comes in contact with shutter 9 during insertion of the card.

[0040] Whether magnetic card 6 comes in contact with shutter 9 is detected by detecting a decrease in the output from magnetic head 7 for detecting insertion of a card. When card 6 comes in contact with shutter 9, the speed of the card to be inserted is lowered wherein the output from magnetic head 7 is lowered or disappears.

[0041] Also, one may mount detector 30, such as a

micro switch, to detect that magnetic card 6 comes in contact with shutter 9 as indicated with an imaginary line in Figure 1.

**[0042]** Figure 5 shows a flowchart for operation of taking in a magnetic card in the above embodiment. When insertion of magnetic card 6 is detected by magnetic head 7, motor 15 is rotated (started) (ST31, ST32). Then, the output from magnetic head 7 for detecting insertion of a card is lowered or disappears when magnetic card 6 starts to stop or completely stops while being in contact with shutter 9. By monitoring the output, whether the end of inserted magnetic card 6 comes in contact with shutter 9 can be detected. When it is in contact, the process proceeds from ST33 to ST34 wherein shutter 9 is opened. Thereafter, the user pushes in magnetic card 6 further such that the end of magnetic card 6 is held between transferring rollers 11 to start the operation of taking in of the magnetic card (ST35). Then, reading out and writing from / onto magnetic card 6 begins (ST36).

**[0043]** In this method of control, magnetic card 6 inserted from card slot 5 is temporarily stopped when coming in contact with shutter 9. Therefore, one can prevent a magnetic head, which is illegally attached to the outside of the card slot, from reading information of the inserted magnetic card.

**[0044]** In the above embodiment, one can prevent an illegally attached magnetic head from reading information on a magnetic card by controlling transferring of the magnetic card. One may employ the following configuration with or without the above control of transferring operation.

**[0045]** In the first configuration, a configuration at the outside of card slot opening 4 of front panel 3 is altered such that magnetic head 20 cannot be mounted thereat. In this case, as shown in Figure 6, a part of slot frame 60, which defines card slot 5 of magnetic card reader 1, is projected from opening 4 of front panel 3. Projection 61 faces a magnetic strip of inserted magnetic card 6; hence, it is preferable to form projection 61 on both top and bottom thereat in the case of handling a magnetic card having magnetic strips on both sides.

**[0046]** This configuration makes illegal mounting of a magnetic head to the outside of card slot 5 difficult or impossible. Therefore, one may prevent a magnetic head from illegal reading out of information on a magnetic card.

**[0047]** In the second configuration, illegal reading out can be prevented by detecting whether a foreign object, such as a magnetic head, is illegally attached to card slot opening 4 of the front panel. As shown in Figure 7, detector 70 is attached on the back side of the front panel at a position in the vicinity of card slot 5; detector 70 detects whether a foreign object, such as magnetic head 20, is illegally attached to the front surface of the front panel.

**[0048]** As detector 70, for example, one may employ an optical reflective sensor shown in Figure 7; a

foreign object on the front surface can be detected forming detection opening 71 on front panel 3. Instead of a reflective sensor, one may employ a microwave sensor, a metal detecting sensor, or a mechanical sensor such as a micro switch.

**[0049]** In the third configuration, even though a magnetic head is illegally mounted at card slot opening 4 of front panel 3, reading of a magnetic card can be disabled by a disturbance magnetic field generator. As shown in Figure 8, disturbance magnetic field generator 80, in which coil 82 is wound around iron core 81, is attached in the vicinity of card slot 5 to prevent magnetic head 20, illegally attached to the outside of the front panel, from reading of a magnetic card by generating a disturbance magnetic field. A current in coil 82 can be either direct or alternating.

**[0050]** In general terms, according to one aspect of the present invention, there is provided a magnetic card transaction apparatus that has means for causing a discontinuity in the transfer path or movement along that path of said magnetic card, when the magnetic card projects outwardly from the card slot. In this way, it is possible to prevent reading of the magnetic card by a magnetic head, which is illegally mounted on the outside of the card slot. For example, as described above, in a magnetic card transaction apparatus of the present invention, transferring of a magnetic card is either temporarily suspended or the direction of transferring is reversed during the operation of taking in or ejecting the card from a card slot. However, the present invention is not limited to the above embodiments. For example, instead of reversing the direction of travel, one may alter the card transferring speed such that it is difficult to read a magnetic strip with a magnetic head.

**[0051]** A skilled person will appreciate that variations of the disclosed arrangements are possible without departing from the invention. Accordingly, the above description of a specific embodiment is made by way of example and not for the purposes of limitation. It will be clear to the skilled person that minor modifications can be made without significant changes to the operation described above.

## Claims

### 1. A magnetic card transaction apparatus comprising:

a card slot through which a magnetic card is insertable;

a card transferring means for transferring a magnetic card inserted into the card slot; and means for causing a discontinuity in the transfer of the magnetic card by the card transferring means when the magnetic card projects outwardly from the card slot.

### 2. A magnetic card system as claimed in claim 1, wherein the means for causing a discontinuity are

operable to suspend the transfer of the card.

3. A magnetic card transaction apparatus as claimed in claim 1 or claim 2, wherein the means for causing a discontinuity are operable to temporarily reverse a direction of travel of the magnetic card. 5
4. A magnetic card transaction apparatus as claimed in claim 1, wherein the means for causing a discontinuity are operable to vary a transfer speed of the magnetic card. 10
5. A magnetic card transaction apparatus as claimed in any one of the preceding claims, wherein the card transferring means are operable to take in and/or eject said magnetic card from said card slot. 15
6. A method of operating a magnetic card transaction apparatus that has a card slot through which a magnetic card is insertable and a card transferring means for transferring a magnetic card inserted into the card slot, the method comprising: 20

transferring a magnetic card to and/or from the card slot using the card transferring means, and 25

causing a discontinuity in the transfer of the magnetic card by the card transferring means when the magnetic card projects outwardly from the card slot, preferably wherein the step of causing a discontinuity involves temporarily suspending the transfer of the card and/or temporarily reversing the direction of travel of the magnetic card and/or varying the transfer speed of the magnetic card. 30 35

7. A magnetic card transaction apparatus comprising: 40

a card slot into which a magnetic card is insertable; 40

a detecting means which detects that a magnetic card is inserted into the card slot;

a card transferring means for transferring the magnetic card;

a shutter which opens or closes a card guiding path for guiding the magnetic card inserted from the card slot to the card transferring means; and 45

a control means which controls the shutter means to open the card guiding path when the detecting means detects that the magnetic card is inserted and which drives the card transferring means to transfer the magnetic card a given period of time after the card guiding path is opened. 50 55

8. A magnetic card transaction apparatus comprising:

a card slot into which a magnetic card is insertable;

a card insertion detecting means which detects that the magnetic card is inserted into the card slot;

a card transferring means for transferring said magnetic card;

a shutter means which opens or closes a card guiding path guiding the magnetic card inserted from the card slot to the card transferring means;

a detecting means which detects that the magnetic card inserted from said card slot comes in contact with the shutter means; and

a shutter controlling means which opens the guiding path by driving the shutter means after the detecting means detects that the magnetic card comes in contact with said shutter means.

9. A magnetic card transaction apparatus comprising:

a card slot into which a magnetic card is insertable;

card transferring means for transferring the card, and

detecting means for detecting a foreign object external to the card slot, preferably wherein the detecting means comprise at least one of the following an optical reflective sensor, a metal detector and a mechanical switch.

10. A magnetic card transaction apparatus comprising:

a card slot into which a magnetic card is insertable;

card transferring means for transferring the card and

means for disturbing an externally applied magnetic field, preferably wherein the means for disturbing an external magnetic field comprising a coil, preferably wound around an iron core.

11. A magnetic card transaction apparatus comprising a card slot into which a magnetic card bearing a magnetic strip is insertable and card transferring means for transferring the card, wherein the card slot is defined or surrounded by an external frame that is shaped so as to substantially cover any portion of the magnetic strip that extends externally of the slot when the card is being transferred by the card transferring means.

**Fig. 1**

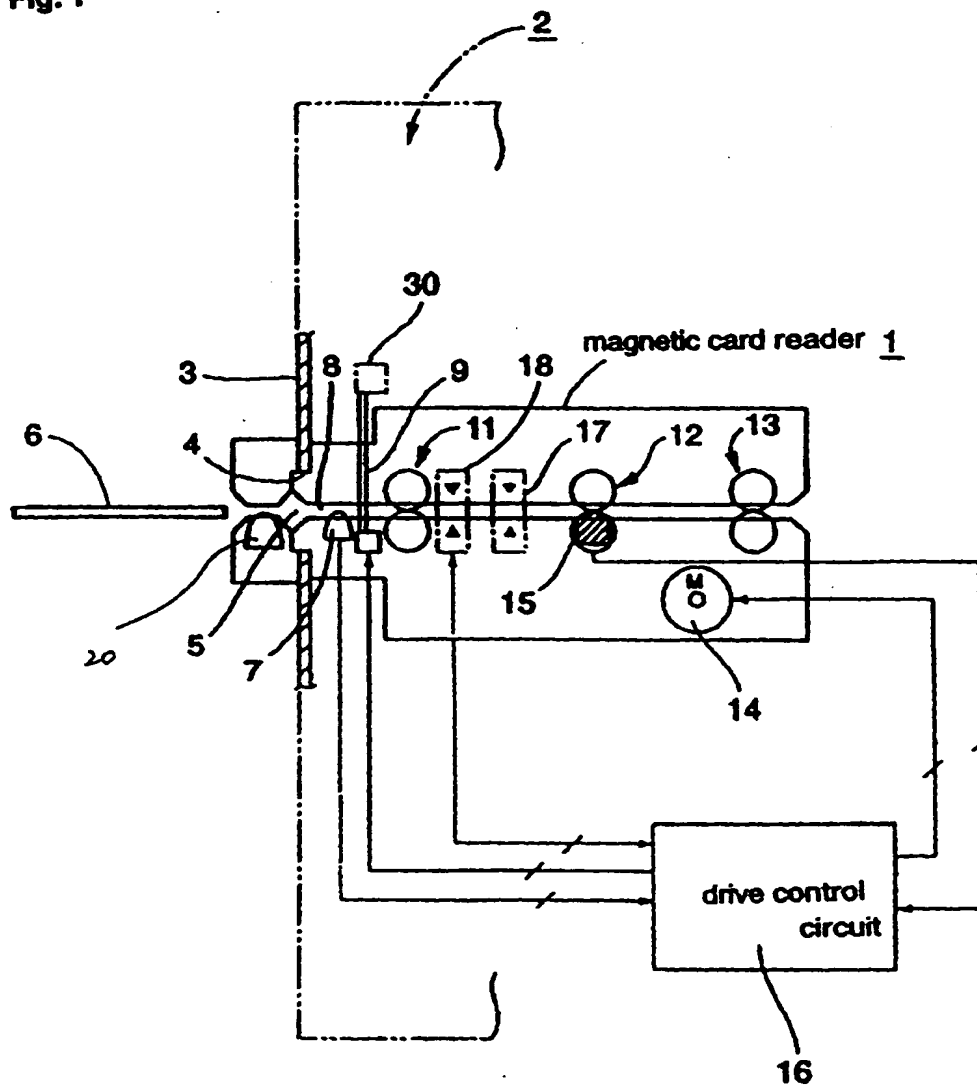


Fig.2(a)

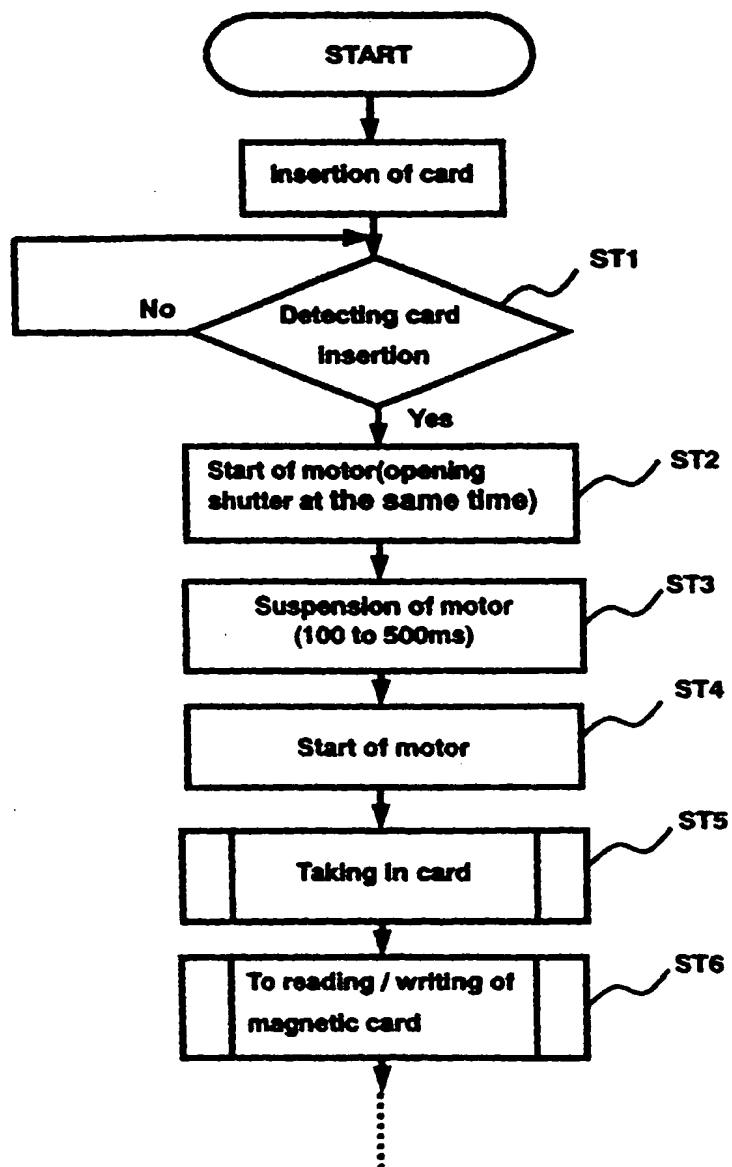
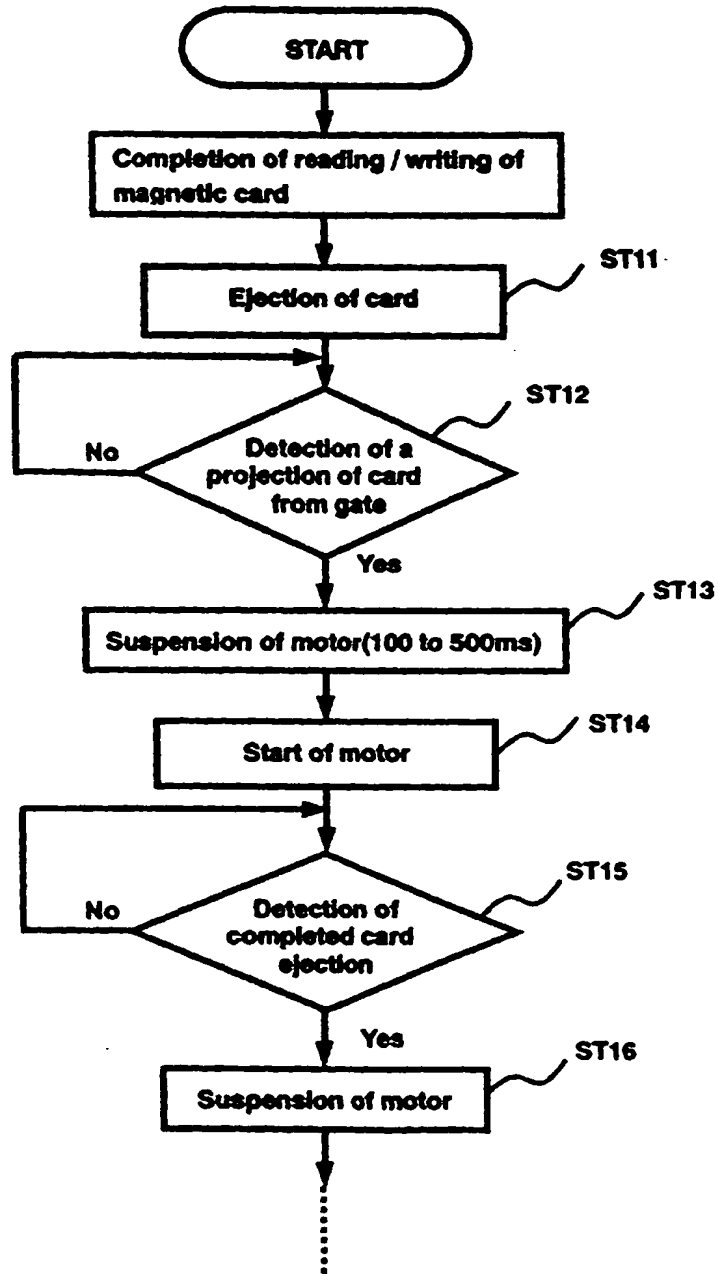
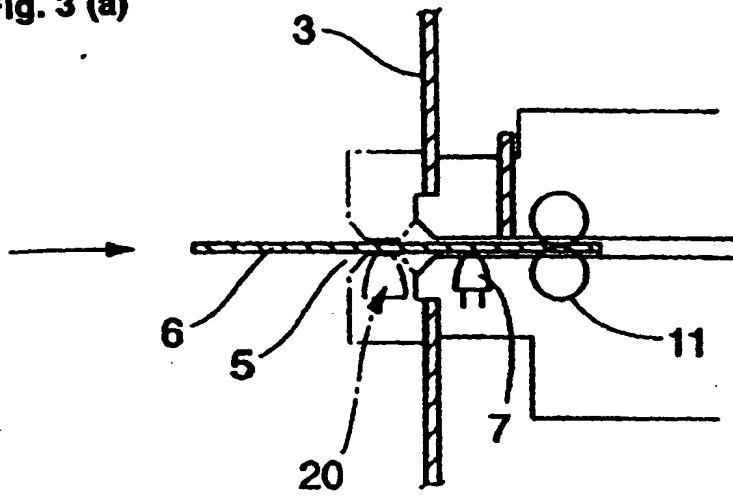




Fig.2(b)



**Fig. 3 (a)**



**Fig. 3 (b)**

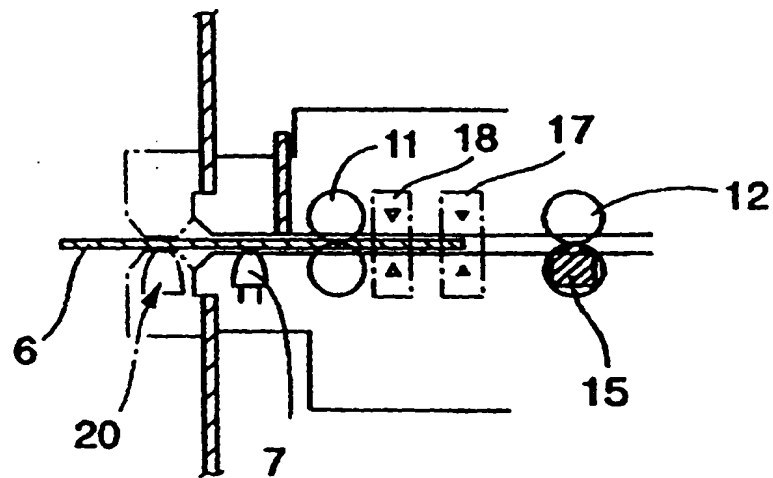


Fig.4

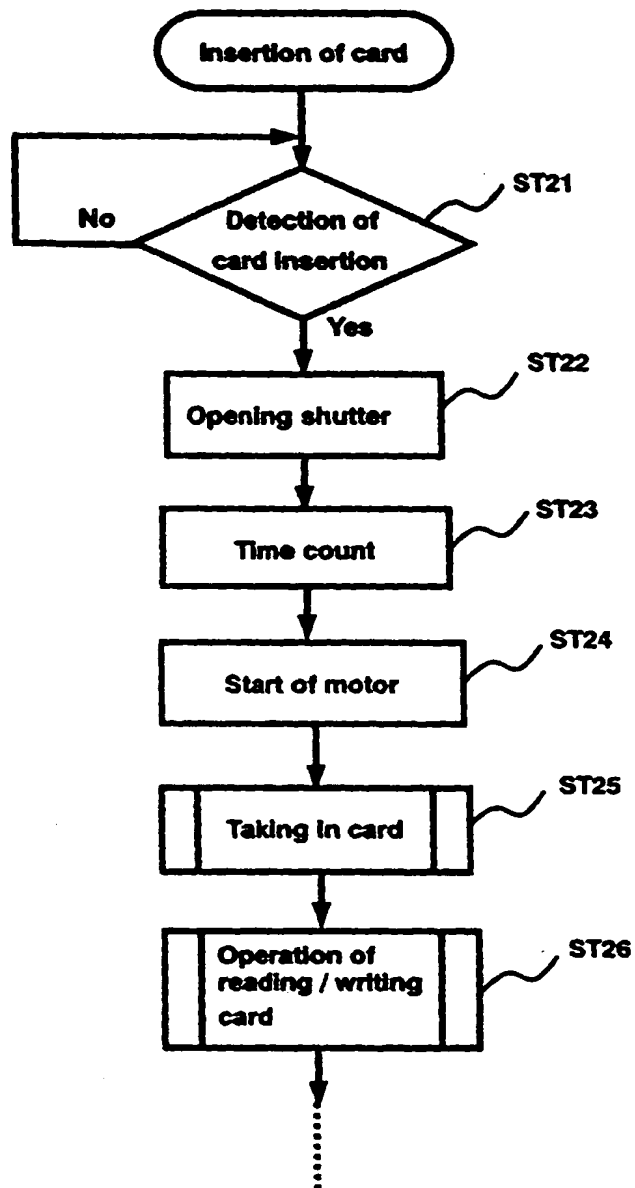
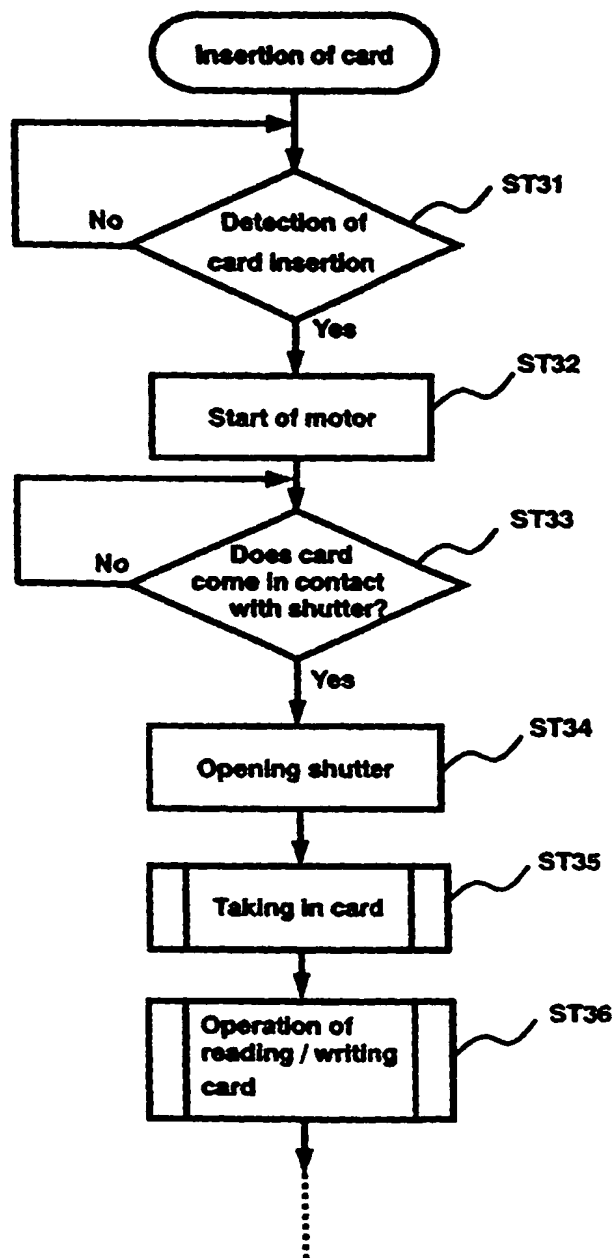
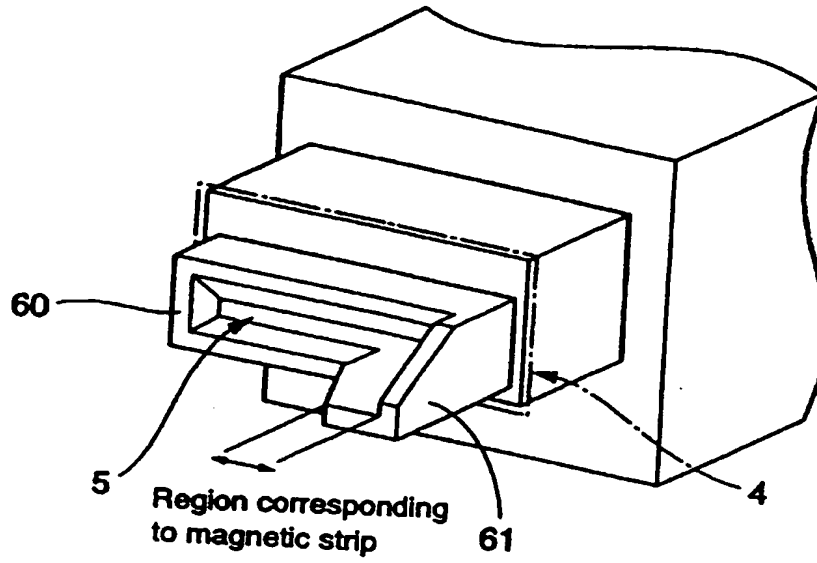


Fig.5



**Fig. 6 (a)**



**Fig. 6 (b)**

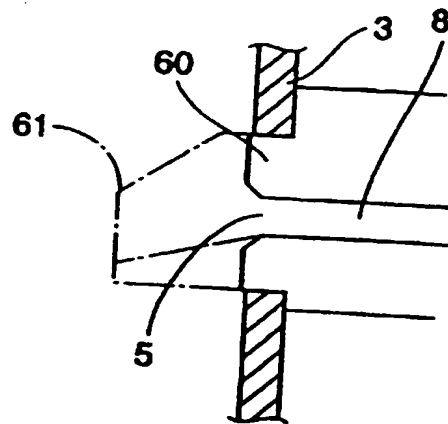


Fig. 7

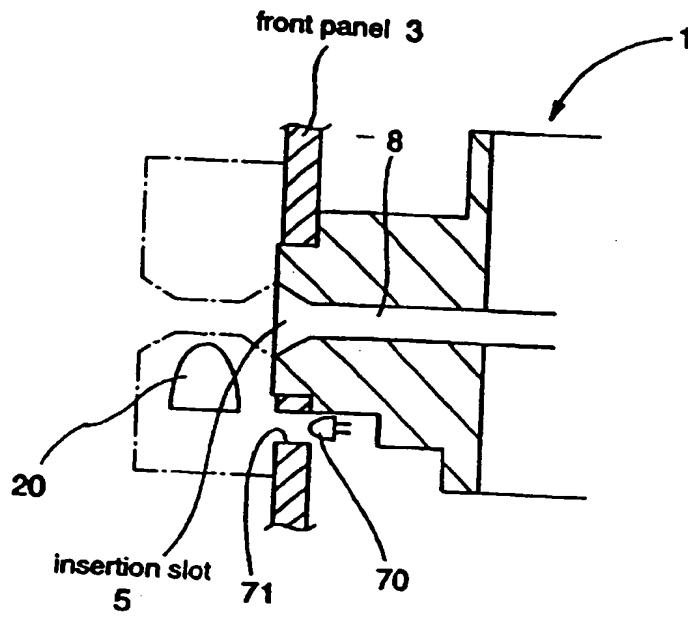


Fig. 8

